

HEATH BRIDGE  
Blomberg Road over Chippewa River  
Vicinity of Exeland  
Sawyer County  
Wisconsin

HAER No. WI-66

HAER  
WIS  
57-EXEL.V,  
1-

PHOTOGRAPHS  
WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record  
National Park Service  
Rocky Mountain Regional Office  
Department of the Interior  
P.O. Box 25287  
Denver, Colorado 80225

HAER  
WIS  
57-EXEL-V,  
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HISTORIC AMERICAN ENGINEERING RECORD  
HEATH BRIDGE

**Location:** Blomberg Road over the Chippewa River,  
vicinity of Exeland, Weirgor Township, Sawyer County, Wisconsin

**UTM:** A (west end): 15:640235:5060690  
B (east end): 15:640260:5060740

**Quad:** Exeland, Wisconsin

**Date of Construction:** 1914

**Present Owner:** Sawyer County

**Present Use:** Bridge, scheduled for demolition in 1991

**Significance:** Crossing the Chippewa River in southern Sawyer County, Wisconsin, the Heath Bridge is a steel, riveted, two-span, overhead, Pratt truss highway bridge. Constructed in 1914, it is one of the first bridges of its type built in Wisconsin according to a standardized state plan. It is also one of only two bridges recognized by the Wisconsin Historic Bridge Advisory Committee as "the best examples of Pratt overhead trusses" built in Wisconsin between 1911 and 1925. In its design and material, the Heath Bridge exemplifies a once common bridge type and, as one of the few remaining, was declared eligible for the National Register of Historic Places in the spring of 1991.

**Historians:** Robert Hybben and Jeffrey A. Hess

## Introduction

Crossing the Chippewa River in section 14 of Weirgor Township in the southern part of Sawyer County, Wisconsin, the Heath Bridge is one of two bridges recognized by the Wisconsin Historic Bridge Advisory Committee as "the best examples of Pratt overhead trusses" built in Wisconsin between 1911 and 1925.<sup>1</sup> The bridge is approximately 230 feet long, comprised of two consecutive, virtually identical, 113-foot, steel, 7-panel, riveted, overhead Pratt trusses. It has a 16-foot roadway of bituminous-covered wood decking over I-beam stringers and I-beam floor beams. Angle-iron railings border the roadway. Two cement-filled steel cylinders connected by built-up plates form a dumbbell pier supporting the two spans in midstream. Embankment ends rest on concrete abutments. Constructed in 1914, the Heath Bridge was one of the first bridges of its type in Wisconsin built according to a standardized state plan. In its design and material, the Heath Bridge exemplifies a once common bridge type and, as one of the few remaining, was declared eligible for the National Register of Historic Places in the spring of 1991.<sup>2</sup>

## History and Significance of the Heath Bridge

The introduction of standardized state plans, such as the one used for the Heath Bridge on the Chippewa River in Sawyer County, marked an important advance in highway bridge construction in Wisconsin. Although the idea of standardized design was at least as old as the Industrial Revolution, it became increasingly important in the United States after the Civil War, as regional industries attempted to find a national market for their goods. Since the creation of a national market demanded, and heavily rewarded, an efficient transportation system, it is not

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<sup>1</sup> Cultural Resource Management in Wisconsin: A Manual for Historic Properties, vol. 2 (Historic Preservation Division, State Historical Society of Wisconsin, June 1986), 12-14.

<sup>2</sup> Charlene K. Roise, Heath Bridge, National Register of Historic Places Registration Form, prepared by Hess, Roise and Company for Wisconsin State Historic Preservation Office, Madison, March 1991.

surprising that railroads were the first major industry to standardize operations. As historian Alfred D. Chandler, Jr., has noted, "until the roads were linked, and until procedures and equipment were made uniform, freight could not follow quickly and easily across the lines of several roads." Relying on both friendly cooperation and ruthless consolidation, the railroads succeeded so well in integrating their lines that "by the 1880s a rail shipment could move from one part of the country to another without a single transshipment."<sup>3</sup>

The railroads also were among the first to exploit standardization for its public-relations potential, especially in the area of bridge design. During the 1870s and 1880s, the American public was shocked by several catastrophic railroad bridge failures that were attributed to incompetent design and construction.<sup>4</sup> To reassure their customers, railroad companies emphasized programs of bridge maintenance and replacement, and championed the professionally-prepared standardized plan as a guarantee of quality and safety. As the chief engineer of the Chicago, Milwaukee and St. Paul Railway explained in 1895:

We have for several years been steadily engaged in preparing standard plans and specifications . . . . Our rule is to apply the test of practice before making a standard. . . . We built probably thirty Howe truss spans from our present plans before adopting them as standard, and when there were no farther changes to propose in them, [we] had the plans printed. . . . Our wooden trestle bridges were treated in the same manner, and we now have perhaps as much as fifty miles of bridges built from plans which would make a package that a workman can carry in his pocket. This duplication provides for a standard factor of safety in the bridges and secures good workmanship and great economy in construction, both from the proficiency which the workers attain, and from the small variety of sizes and kinds of material which it is necessary to carry in stock.<sup>5</sup>

During the 1890s, it became clear to many Americans that standardization of design and construction also would benefit the public transportation infrastructure. However, unlike the

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<sup>3</sup> Alfred D. Chandler, Jr., The Visible Hand (Cambridge: Harvard University Press, 1977), 123-124.

<sup>4</sup> Donald C. Jackson, "19th Century American Bridge Failures: A Professional Perspective," Proceedings of the 2nd Historic Bridge Conference (Columbus, Ohio: Ohio State University and Ohio Historical Society, 1988), 116-118.

<sup>5</sup> Onward Bates, An Address to Employees [sic] (Milwaukee: Ed Krogh, Printer, 1895), 16.

highly centralized railroad network, the management of public highways and bridges typically was splintered, even within a single state, among hundreds of jurisdictions, such as counties, townships, and cities. Recognizing that standardization required centralization of authority, voters in Massachusetts and New Jersey in the early 1890s created state highway departments to build uniform roads and bridges with state funds. Over the next 25 years, the rest of the nation eventually followed suit.<sup>6</sup>

In Wisconsin, the "good roads movement," as it was called, faced a particularly difficult challenge in that the state constitution prohibited the use of state funds for internal improvements. Beginning in 1895, highway reformers introduced an amendment to allow state aid for roads at every session of the legislature until it finally was approved at the required consecutive sessions in 1905 and 1907. In 1907, the legislature also took the first step towards administering a state highway program by creating a Highway Division within the State Geological and Natural History Survey, which previously had been involved with the testing of road materials. Staffed by professional engineers, the Highway Division was given the responsibility of educating and advising local governments about progressive practices in highway engineering.<sup>7</sup>

In 1908, the Highway Division set up a special bridge department under the supervision of M.W. Torkelson, a 1904 graduate in civil engineering from the University of Wisconsin. Torkelson would remain with the state highway program for the next 20 years. Looking back on his early days with the Highway Division, Torkelson declared that "both road and bridge work [in Wisconsin] were in a deplorable state, particularly bridge work, which was not only poorly designed and poorly

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<sup>6</sup> Bruce E. Seely, "Engineers and Government-Business Cooperation: Highway Standards and the Bureau of Public Roads," Business History Review 58 (Spring 1984): 53-56.

<sup>7</sup> The state-aid highway amendment became law in 1908, after ratification by the general electorate. On the good roads movement in Wisconsin, see "Out Of the Mud," Wisconsin Then and Now 17 (May 1971): 4-5; Ballard Campbell, "The Good Roads Movement in Wisconsin, 1890-1911," Wisconsin Magazine of History 49 (Summer 1966): 273-293; Jeffrey A. Hess and Robert M. Frame III, Historic Highway Bridges in Wisconsin, Volume 1. Concrete-Arch and Stone-Arch Bridges (Madison: Wisconsin Department of Transportation, 1986), 96-97, 240-244.

built but oftentimes carried out with a great deal of plain graft. . . ."<sup>8</sup> Like many other highway reformers, Torkelson believed that the main culprit was a time-honored system of procurement, whereby bridge-building companies submitted bids based on their own engineering plans, and untrained local officials attempted to select the best bridge for the money. As Torkelson explained:

The method of letting these contracts is such as to increase the difficulty of securing good work. The ordinary method is to give notice that at a certain time and place the town board and county commissioners will meet to receive bonds and award the contract for a bridge of a specific span and roadway. . . . Generally there is no information given regarding the substructure. The contractor, however, prepares his plan as best he can, drives out to the bridge site on the morning of the letting and puts in his bid generally in the afternoon. The bids are opened and the prices read. Since there is no uniformity in the plans there is no real basis for comparison of the bids. The low bid may be on such an inferior design that it should receive absolutely no consideration . . . . The officials, having at best very little knowledge regarding the plans, then usually go into a room by themselves and call in the contractors' agents one by one to have them "explain" their plans . . . . The low bidder tries to convince the officials that his plan is as good as they need . . . . Each of the others tries to convince them that his particular plan is the happy combination of price with value . . . . The result of these "explanations" is generally to confuse rather than to explain and to leave the officers less able to render good judgment than before hearing them.<sup>9</sup>

Although Torkelson did not allude to any specific bridge project, he may have had in mind an unfortunate affair that occurred in Sawyer County in 1907. Located in heavily timbered northwestern Wisconsin, Sawyer County remained largely unsettled until the early 1900s, when logging companies put thousands of acres of cut-over land on the market. At that time, branch lines of the Omaha Road and Soo Line began depositing homesteaders at tiny whistle stops known as Radisson, Exeland, and Weigor. Between 1900 and 1920, the county's population grew from

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<sup>8</sup> M.W. Torkelson, "State Work in Wisconsin Has Improved Bridges and Engineering," Engineering News-Record 91 (August 30, 1923): 345. For Torkelson's background, see his obituary in Wisconsin State Journal, April 3, 1963.

<sup>9</sup> Torkelson, as quoted in Hans Nelson Brue, "The Development of Highway Bridges in Wisconsin," unpublished civil engineering thesis, University of Wisconsin, 1916, 15-16.

3,593 to 8,243.<sup>10</sup> Increased settlement brought increased calls upon the Sawyer County Board for highway improvements. In 1906, for example, the Town of Radisson in the southern part of the county petitioned the county board to build a bridge over the Chippewa River, a major north-south waterway. The board responded by selecting, on a low-bid basis, an out-of-state company to erect the structure according to the company's own plans and under its own supervision. In March 1907, a committee of county supervisors recommended full payment to the contractor, having "carefully examined the new steel bridge . . . and found [it] to be in full compliance with all provisions of the contract." One month later, the bridge collapsed of its own weight. A professional engineer hired by the county to investigate the matter placed the blame directly on the contractor and indirectly on the county board. "An inspection by a competent engineer," he reported, " . . . would almost certainly prevent the acceptance of such a structure."<sup>11</sup>

In 1911, the Wisconsin State Legislature transformed the Highway Division into an autonomous State Highway Commission (SHC) with statutory powers to prepare all plans for state-aid highway projects and to approve all plans for county projects. Dedicated to creating a "uniform standard type of construction" for highways throughout Wisconsin, Torkelson immediately prepared a set of standardized bridge plans for spans ranging from six to 150 feet. During its first five years, the SHC mailed out an estimated 16,000 blueprints of bridge superstructures, including the plans

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<sup>10</sup> There is no detailed history of Sawyer County. For brief sketches of the area and its communities, see A History of the Origin of Place Names Connected with the Chicago and North Western and Chicago, St. Paul, Minneapolis and Omaha Railways (Chicago: n.p., 1908), 202; Otto Christianson, Platbook of Sawyer Co., Wisconsin (Christianson, 1897), 72-116; Map of Sawyer County (Ladysmith, WI: Upper Wisconsin Land Co., 1916); Wisconsin State Gazetteer and Business Directory, 1909-1910 (Chicago and Detroit: R.L. Polk and Co., 1909); Wisconsin State Gazetteer and Business Directory, 1915-1916 (Detroit and Chicago: R.L. Polk and Co., 1915).

<sup>11</sup> "Proceedings of the Board of Supervisors of Sawyer County, Wisconsin," March 19, May 22, 1907, in Sawyer County Courthouse, Hayward, Wisconsin.

for the Heath Bridge in the Town of Weigor in southern Sawyer County.<sup>12</sup>

In 1912, the Town of Weigor petitioned the Sawyer County Board to build two bridges within a mile of each other on the Chippewa River, one carrying a north-south road in section 14 and the other an east-west road in section 24. For all practical purposes, the Town of Weigor had just sprung into existence. Unlisted in the federal census of 1900, it reported a population of 260 in 1910. Both bridge sites were about two miles northeast of the area's largest community, Exeland, which contained about 40 residents. The north-south road in section 14 was a well-established route through northwestern Wisconsin. It had been served by a ferry over the Chippewa at least as early as 1878. If the ferry were still in operation in 1912, it might explain why the county board denied the request for a bridge at this site, although it did approve the new crossing in section 24. Two years later, the Town of Weigor renewed its bridge petition for section 14, and this time the county board agreed to the project. As specified by state law, the cost was to be equally divided between town and county.<sup>13</sup>

When the SHC completed plans for the new bridge in May 1914, the drawings referred to the structure as the "Heath Bridge."<sup>14</sup> The SHC derived its design for the Heath Bridge from its standard plan for a riveted, overhead, Pratt truss with a horizontal top chord -- the structural type

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<sup>12</sup> Second Biennial Report Showing Operations of the Wisconsin Highway Commission, July 1, 1911, to January 1, 1915 (Madison: Published by the State, 1915), 24.

<sup>13</sup> Sawyer County Board Proceedings, June 21, September 26, 1912; April 22, October 2, 1914. For the population Exeland, see Wisconsin State Gazetteer, 1909-1910, 333; Wisconsin State Gazetteer, 1915-1916, 292. The ferry crossing is shown in "Chippewa County," Historical Atlas of Wisconsin (Snyder and Van Vechten, 1878).

<sup>14</sup> The origin of this name is unknown. The only available plat map for the area from this period does not include anyone named Heath as a property owner in the vicinity of the bridge, nor do the county board proceedings concerning the bridge shed light on the matter. During the 1880s, however, a banker and lumberman named Jeff T. Heath was active in the affairs of Barron County, which adjoins Sawyer County on the southwest. It is possible that the bridge was named for this gentleman or members of his family; see George Forrester, ed., Historical and Biographical Album of the Chippewa Valley, Wisc. (Chicago: Warner, 1892), 332, 436; Plat Book of Sawyer County, Wisconsin (Rockford, Ill.: W.W. Hixson and Company, 1918?).



avored by the agency for spans ranging from 80 to 135 feet in length.<sup>15</sup> In the Heath Bridge, this translated into two 113-foot-long spans with concrete abutments and a concrete-filled, steel-cylinder river pier. Although the SHC repeatedly advocated the use of concrete floors in steel truss bridges, the Heath Bridge was apparently designed and built with a wood floor. The reason for this departure is unknown.<sup>16</sup>

In addition to being one of the first overhead Pratt truss bridges in Wisconsin built according to a standardized state plan, the Heath Bridge also is notable for its riveted construction. During the late nineteenth and early twentieth centuries, most bridge companies used pin-connected joints in their designs. They argued that pins provided a proper distribution of stress through the structure and required less metal, thus allowing lighter structures. Many also doubted that rivets could be properly driven in the field. During the 1890s, however, an increasing number of engineers challenged these beliefs, arguing that riveting increased a bridge's rigidity, thus reducing vibrations that could cause the pin to grind in its eye hole and loosen.<sup>17</sup> Under Torkelson, the state highway program advocated riveted connections exclusively for short-span

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<sup>15</sup> Patented by Thomas and Caleb Pratt in 1844, the Pratt truss is a design with vertical compression members and diagonal tension members. Because of its strength and uncomplicated design, it was the most popular long-span bridge type in both the nation and Wisconsin during the late nineteenth and early twentieth centuries; see Donald C. Jackson Great American Bridges and Dams (Washington, D.C.: Preservation Press, 1988), 24; Robert Newbery and H.W. Guy Meyer, "Ordinary Iron Highway Bridges," Wisconsin Academy Review 30 (March 1984): 35.

<sup>16</sup> For the SHC plans for the Heath Bridge, see Drawings N521, N563, N565, microfilm, Wisconsin Department of Transportation, Madison. The basic standard plan for this type of overhead Pratt truss is filed as Drawing A15. As Brue noted in 1916 (p. 43), the SHC used concrete-filled tubular piers "quite extensively . . . where the current is not swift and where considerable depth must be reached to secure good bearing." The SHC's standards for span type are listed in "The Organization and Standards of the Wisconsin Highway Commission," Engineering and Contracting 42 (October 28, 1914) 401-411. The same source recommends reinforced-concrete floors for long-span riveted Pratt trusses; see also Biennial Report, 1911-1915, 24.

<sup>17</sup> J.A.L. Waddell, Economics of Bridgework: A Sequel to Bridge Engineering (New York: John Wiley & Sons, Inc., 1921), 73-74; Alfred P. Boller, Practical Treatise on the Construction of Iron Highway Bridges, (n.p., 1890), 44-49; "Discussion of American Railroad Bridges," American Society of Civil Engineers, Transactions 26 (December 1889): 593.

trusses as early as 1908. As one of the first state-plan examples of riveted long-span, truss construction, the Heath Bridge helped establish the SHC's confidence in the design. In 1914, while the Heath Bridge was under construction, the SHC announced that it "very seldom" used a pin-connected truss. Two years later, a close observer of the SHC noted that "the use of pin connected trusses has been completely abandoned."<sup>18</sup>

In the spring of 1914, Sawyer County awarded the Heath Bridge contract to the Worden-Allen Company, low bidder at \$6,500. Established in 1902 by Beverly L. Worden and Clarence J. Allen, the firm had headquarters in Milwaukee and branch offices in Chicago and Houghton, Michigan. As historian Robert Newbery has noted, the operation probably was "more Worden than Allen," since the latter appears to have been actively associated with the company only until 1907. Worden, on the other hand, apparently remained on board until his death in 1931. A civil-engineering graduate from the University of Wisconsin and a former bridge engineer of the Wisconsin Bridge and Iron Company, Worden guided his fledgling company to become one of the largest bridge fabricating and erecting firms in the Midwest. Within a decade of its founding, Worden-Allen boasted an annual structural steel capacity of 12,000 to 15,000 tons and gross receipts exceeding one million dollars. The company displayed an early interest in all-riveted bridge construction. Having fabricated and built Wisconsin's first known, riveted, overhead Pratt highway truss in 1909, it was already familiar with the design when it received the contract for building the Heath Bridge. Without incident, it completed its work on the Heath Bridge in November 1914.<sup>19</sup>

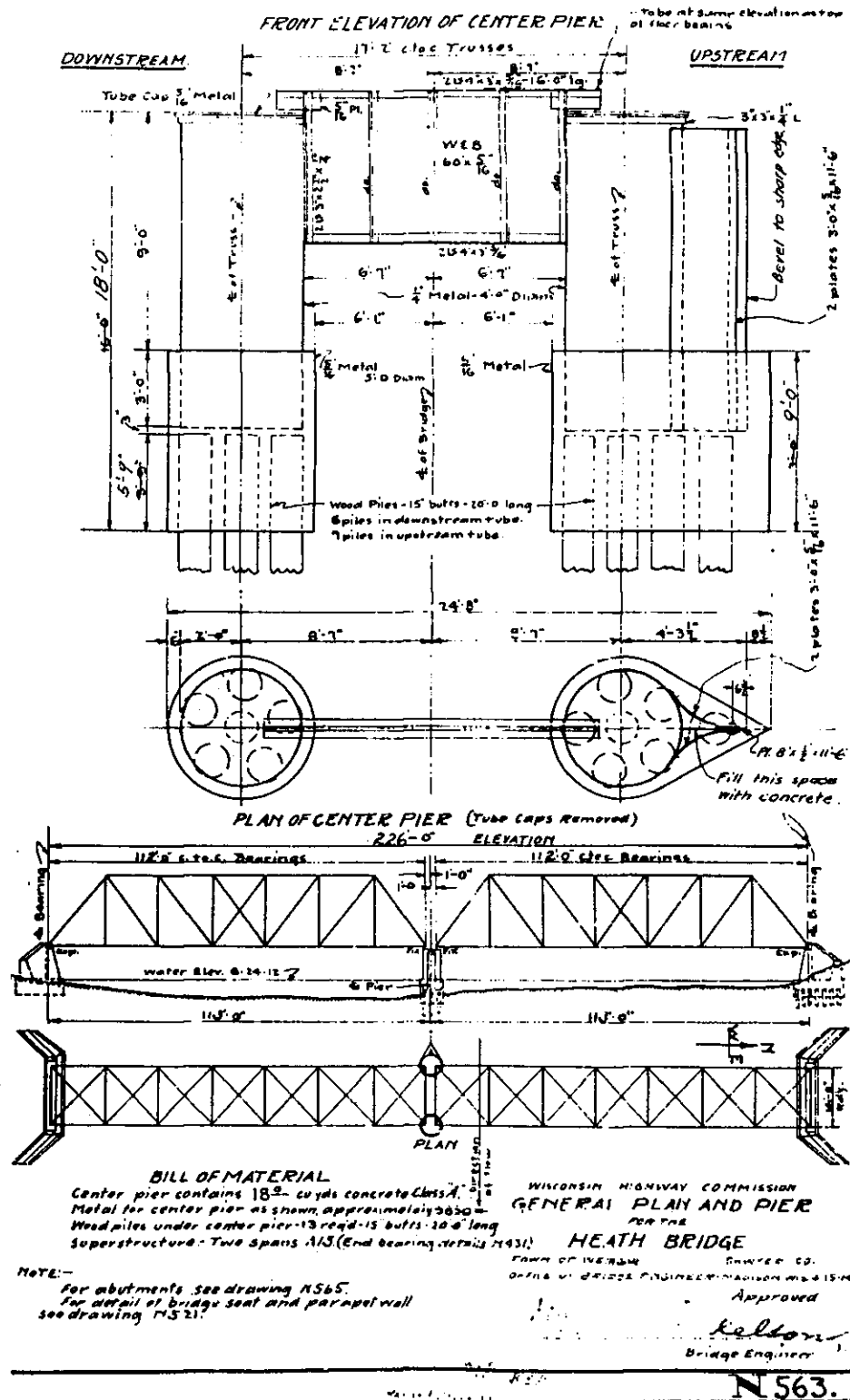
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<sup>18</sup>See photograph of "a riveted steel [Pratt pony truss] highway bridge 40' span. . . built under the supervision of the Highway Division" in Arthur H. Hirst and M.W. Torkelson, Culverts and Bridges, (Madison, WI: Highway Division, Wisconsin Geological and Natural History Survey, 1908), 43. Concerning the SHC and pin connections, see "The Organization and Standards of the Wisconsin Highway Commission" (1914): 402; Brue, 32.

<sup>19</sup>"Proceedings," County, October 2, 1914; November 5, 1914. For information on Worden-Allen Company, see Robert Newbery and others, Historic Highway Bridges of Wisconsin, Volume 1. Truss Bridges (Madison: Wisconsin Department of Transportation, forthcoming).

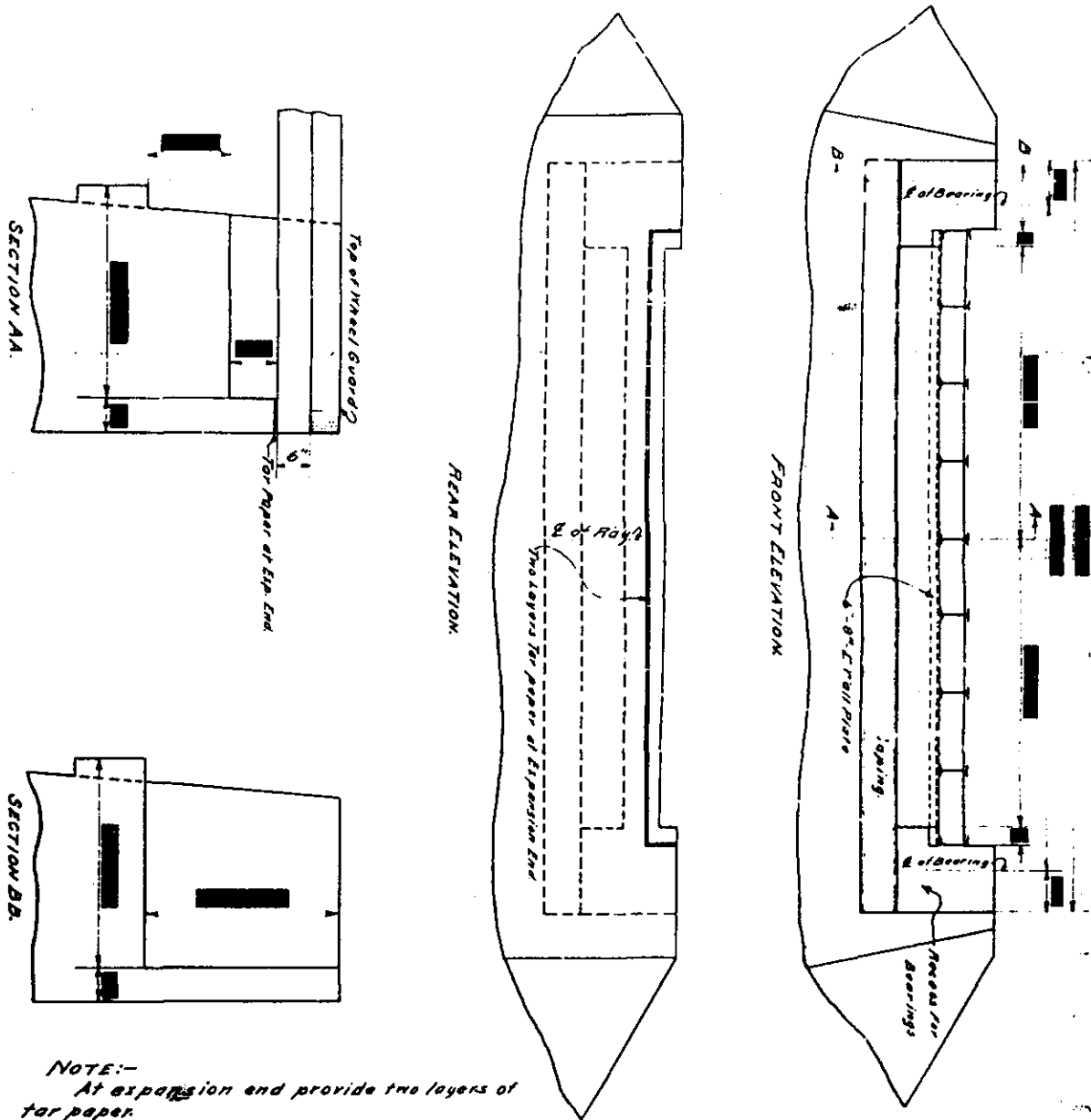
The Heath Bridge survived for nearly seventy years. During the spring of 1991, however, concerns arose over the bridge's safety and the Wisconsin Department of Transportation (WisDOT) considered replacing it. This led to the preparation of a Determination of Eligibility for the National Register of Historic Places. The resulting study confirmed that the bridge was indeed eligible for the National Register as a rare surviving example of a state-designed, riveted, overhead, Pratt-truss, highway bridge. When WisDOT decided to proceed with demolition, it agreed to document the structure according to standards set down by the National Park Service, including preparation of a written historical narrative. The present study is intended to fulfill that obligation.

[Wisconsin Highway Commission. "General Plan and Pier for the Heath Bridge," April 25, 1914;  
revised, May 22, 1914. On microfilm, Wisconsin Department of Transportation.]



**N565**

[Wisconsin Highway Commission. "Detail of Bridge Seat and Parapet Wall," March 5, 1914. On microfilm, Wisconsin Department of Transportation.]



NOTE:-  
At expansion end provide two layers of  
tar paper.  
At fixed end monolithic construction  
shall be used.  
Concrete in parapet walls shall be Class A.

WISCONSIN HIGHWAY COMMISSION.  
DETAIL OF BRIDGE SEAT  
AND  
PARAPET WALL  
CONCRETE FLOORS.

OFFICE OF BRIDGE ENGINEER - MADISON, WIS. 5-54

APPROVED

7/11/35 J. C. Low

BRIDGE ENGINEER

N-521.

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